AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

Claims 1-17 (Cancelled)

18. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface;

wherein, light coming from said second reflecting surface passes out of an effective diameter of said first reflecting surface, and said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and

wherein said catadioptric type optical system and said refraction type optical system are disposed on a single linear optical axis.

19. (Previously Presented) A catadioptric optical system according to Claim 18, wherein said catadioptric type optical system includes a lens group including at least one positive lens, and said refraction type optical system includes an aperture diaphragm.

20. (Previously Presented) A catadioptric optical system according to Claim 18, wherein an exit pupil of said catadioptric optical system is substantially circular.

21. (Previously Presented) A catadioptric optical system according to Claim 18, wherein the following condition is satisfied:

$0.04 < |fM1| / L < 0.4$

wherein fM1 is a focal length of said concave reflecting surface of said first or second reflecting surface, and L is a distance along the optical axis from said first surface to said second surface.

22. (Previously Presented) A catadioptric optical system according to Claim 18, wherein the following condition is satisfied:

$0.6 < |\beta M1| < 20$

wherein $\beta M1$ is a magnification of said concave reflecting surface of said first or second reflecting surface.

23. (Previously Presented) A catadioptric optical system according to Claim 18, wherein the following condition is satisfied:

$0.3 < |\beta 1| < 1.8$

wherein $\beta 1$ is a magnification of said catadioptric type optical system.

24. (Previously Presented) A catadioptric optical system according to Claim 18, wherein said catadioptric type optical system includes a lens group including at least one lens element whose surface is aspherical, and said refraction type optical system includes at least one lens element whose surface is aspherical.

25. (Previously Presented) A catadioptric optical system according to Claim 18, wherein at least one of said

first and second reflecting surfaces is a concave reflecting surface that corrects positive Petzval sum created by said lens element.

26. (Previously Presented) A catadioptric optical system according to Claim 18, wherein the catadioptric optical system has both-sides telecentricity.

27. (Previously Presented) A catadioptric optical system according to Claim 18, wherein said refraction type optical system includes two kinds of glass material.

28. (Previously Presented) A projection exposure apparatus, comprising a catadioptric optical system according to Claim 18 which projects a predetermined pattern on a mask onto a photosensitive substrate.

29. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface

off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a final image of light coming from said object after twice reflected by said first and second reflecting surfaces and directly from said second reflecting surface, onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface.

30. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for

forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and

wherein said catadioptric type optical system and said refraction type optical system are disposed on a single linear optical axis.

31. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface,

wherein said catadioptric type optical system includes a lens group including at least one positive lens, and said refraction type optical system includes an aperture diaphragm.

32. (Previously Presented) A catadioptric optical system according to Claim 29, wherein an exit pupil of said catadioptric optical system is substantially circular.

33. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for

forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and wherein the following condition is satisfied:

$0.04 < |fM1| / L < 0.4$

wherein fM1 is a focal length of said concave reflecting surface of said first or second reflecting surface, and L is a distance along the optical axis from said first surface to said second surface.

34. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for

forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and

wherein the following condition is satisfied:

$0.6 < |\beta M1| < 20$

wherein ßM1 is a magnification of said concave reflecting surface of said first or second reflecting surface.

35. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for

forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and wherein the following condition is satisfied:

$0.3 < |ß1| < 1.8$

wherein ß1 is a magnification of said catadioptric type optical system.

36. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and wherein said catadioptric type optical system includes a lens group including at least one lens element whose surface is aspherical, and said refraction type optical system includes at least one lens element whose surface is aspherical.

37. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and wherein at least one of said first and second reflecting surfaces is a concave reflecting surface that corrects positive Petzval sum created by said lens element.

38. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and wherein the catadioptric optical system has both-sides telecentricity.

39. (Previously Presented) A catadioptric optical system according to Claim 29, wherein said refraction type optical system includes two kinds of glass material.

40. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 29 which projects a predetermined pattern on a mask onto a photosensitive substrate.

Claim 41 (Cancelled)

42. (Previously Presented) A method of manufacturing a catadioptric optical system comprising:

providing a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from

said first reflecting surface, light coming from said second reflecting surface passing out of an effective diameter of said first reflecting surface, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

providing a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and said catadioptric type optical system and said refraction type optical system are disposed on a single linear optical axis.

Claim 43 (Cancelled)

44. (Previously Presented) A method of manufacturing a catadioptric optical system comprising:

providing a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface

off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

providing a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface, wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and

wherein said catadioptric type optical system includes a lens group including at least one positive lens, and said refraction type optical system includes an aperture diaphragm.

45. (Previously Presented) A method of manufacturing a catadioptric optical system according to Claim 42, wherein an exit pupil of said catadioptric optical system is substantially circular.

46. (Previously Presented) A method of manufacturing a catadioptric optical system comprising:

providing a catadioptric type optical system, which includes a lens element, a first reflecting surface and a

second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

providing a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface, wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and wherein said catadioptric type optical system includes a lens group including at least one lens element whose surface is aspherical, and said refraction type optical system includes at least one lens element whose surface is aspherical.

47. (Previously Presented) A method of manufacturing a catadioptric optical system comprising:

providing a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from

said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

providing a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface, wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and wherein at least one of said first and second reflecting surfaces is a concave reflecting surface that corrects positive Petzval sum created by said lens element.

48. (Previously Presented) A method of manufacturing a catadioptric optical system comprising:

providing a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second

reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

providing a refraction type optical system for forming a second image onto a second plane surface which is substantially parallel to said first plane surface, wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first plane surface and said second plane surface, and wherein the catadioptric optical system has both-sides telecentricity.

49. (Previously Presented) A method of manufacturing a catadioptric optical system according to Claim 42, wherein said refraction type optical system includes two kinds of glass material.

Claim 50 (Cancelled)

51. (Previously Presented) A catadioptric optical system comprising:

a catadioptric type optical system, which includes a lens element, a first reflecting surface and a second reflecting surface that reflects light coming from said

first reflecting surface, light coming from said second reflecting surface passing said first reflecting surface off-axis thereof, at least one of said first and second reflecting surfaces being a concave reflecting surface, for forming an intermediate image from an object of a first plane surface; and

a refraction type optical system for forming a second image onto a second plane surface,

wherein, said catadioptric type optical system and said refraction type optical system are disposed between said first and second plane surfaces, and

said first plane surface, said second plane surface and an image plane of said intermediate image are parallel to each other.

52. (Previously Presented) A catadioptric optical system according to Claim 51, wherein said catadioptric type optical system and said refraction type optical system are disposed on a single linear optical axis.

53. (Previously Presented) A catadioptric optical system according to Claim 51, wherein said catadioptric type optical system includes a lens group including at least one

positive lens, and said refraction type optical system includes an aperture diaphragm.

54. (Previously Presented) A catadioptric optical system according to Claim 51, wherein an exit pupil of said catadioptric optical system is substantially circular.

55. (Previously Presented) A catadioptric optical system according to Claim 51, wherein the following condition is satisfied:

$0.04 < |fM1| / L < 0.4$

wherein fM1 is a focal length of said concave reflecting surface of said first or second reflecting surface, and L is a distance along the optical axis from said first surface to said second surface.

56. (Previously Presented) A catadioptric optical system according to Claim 51, wherein the following condition is satisfied:

$0.6 < |\beta M1| < 20$

wherein ßM1 is a magnification of said concave reflecting surface of said first or second reflecting surface.

57. (Previously Presented) A catadioptric optical system according to Claim 51, wherein the following condition is satisfied:

$0.3 < |ß1| < 1.8$

wherein ß1 is a magnification of said catadioptric type optical system.

58. (Previously Presented) A catadioptric optical system according to Claim 51, wherein said catadioptric type optical system includes a lens group including at least one lens element whose surface is aspherical, and said refraction type optical system includes at least one lens element whose surface is aspherical.

59. (Previously Presented) A catadioptric optical system according to Claim 51, wherein at least one of said first and second reflecting surfaces is a concave reflecting surface that corrects positive Petzval sum created by said lens element.

60. (Previously Presented) A catadioptric optical system according to Claim 51, wherein the catadioptric optical system has both-sides telecentricity.

61. (Previously Presented) A catadioptric optical system according to Claim 51, wherein said refraction type optical system includes two kinds of glass material.

62. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 51 which projects a predetermined pattern on a mask onto a photosensitive substrate.

63. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 18; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

64. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 29; and

projecting an image of a predetermined pattern on a mask

onto a photosensitive substrate using the catadioptric optical system.

65. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 30 which projects a predetermined pattern on a mask onto a photosensitive substrate.

66. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 30; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

67. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 31 which projects a predetermined pattern on a mask onto a photosensitive substrate.

68. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 31; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

69. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 33 which projects a predetermined pattern on a mask onto a photosensitive substrate.

70. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 33; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

71. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 34 which projects a predetermined pattern on a mask onto a photosensitive substrate.

72. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 34; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

73. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 35 which projects a predetermined pattern on a mask onto a photosensitive substrate.

74. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 35; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

75. (Previously Presented) A catadioptric optical system according to Claim 51, wherein the catadioptric optical system has both-side telecentricity.

76. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 75 which projects a predetermined pattern on a mask onto a photosensitive substrate.

77. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 75; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

78. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 37 which projects a predetermined pattern on a mask onto a photosensitive substrate.

79. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 37; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

80. (Previously Presented) A catadioptric optical system according to Claim 38, wherein the catadioptric type optical system includes a lens group having at least one positive lens, and the refraction type optical system includes an aperture diaphragm.

81. (Previously Presented) A catadioptric optical system according to Claim 38, wherein the catadioptric type

optical system includes a lens group having at least one lens element whose surface is aspherical, and the refraction type optical system includes at least one lens element whose surface is aspherical.

82. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric optical system according to Claim 38 which projects a predetermined pattern on a mask onto a photosensitive substrate.

83. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 38; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

84. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 51; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

85. (Currently amended) A reduction projection catadioptric optical system for projection exposure, comprising:

at least one lens element and at least one mirror,

wherein the reduction projection catadioptric optical system is devoid of reflective surfaces that bend an optical axis,

the reduction projection catadioptric optical system further comprising an aperture diaphragm on an image side of a most image-wise curved mirror, and said reduction projection catadioptric optical system being constructed so as to provide an exit pupil having no obscuration.

86. (Previously Presented) A reduction projection catadioptric optical system according to Claim 85, wherein the reduction projection catadioptric optical system has a numerical aperture of 0.6 or more.

87. (Previously Presented) A reduction projection catadioptric optical system according to Claim 85, wherein

there is a straight axis of symmetry of all curvatures of all optical elements.

88. (Previously Presented) A reduction projection catadioptric optical system according to Claim 85, wherein the reduction projection catadioptric optical system forms an intermediate image, and wherein at least two mirrors are arranged upstream of the intermediate image in an optical path.

89. (Previously Presented) A reduction projection catadioptric optical system according to Claim 85, further comprising a lens group next to an object plane, wherein the reduction projection catadioptric optical system has object-side telecentricity.

90. (Previously Presented) A reduction projection catadioptric optical system according to Claim 85, wherein an exit pupil of the reduction projection catadioptric optical system is substantially circular.

91. (Previously Presented) A projection exposure apparatus which projects a predetermined pattern on a mask onto a photosensitive substrate, comprising a catadioptric

optical system according to Claim 85 which projects a predetermined pattern on a mask onto a photosensitive substrate.

92. (Previously Presented) A projection exposure method comprising:

preparing a catadioptric optical system according to Claim 85; and

projecting an image of a predetermined pattern on a mask onto a photosensitive substrate using the catadioptric optical system.

93. (Previously presented) A reduction projection catadioptric optical system according to claim 85, wherein the reduction projection catadioptric optical system forms an image of an object off an optical axis of the reduction projection catadioptric optical system.

Claim 94 (cancelled)

95. (Currently amended) A reduction projection catadioptric optical system according to claim ~~94~~93, wherein there is a straight axis of symmetry of all curvatures of all optical elements.

96. (Currently amended) A reduction projection catadioptric optical system according to claim ~~94~~93, wherein the reduction projection catadioptric optical system forms an intermediate image, and wherein at least two mirrors are arranged upstream of the intermediate image in an optical path.

97. (Currently amended) A reduction projection catadioptric optical system according to claim ~~94~~93, further comprising a lens group next to an object plane, wherein the reduction projection catadioptric optical system has object-side telecentricity.

98. (Currently amended) A reduction projection catadioptric optical system according to claim ~~94~~93, wherein a shape of an exposure area of the reduction projection catadioptric optical system is a slit-like shape.

99. (Previously presented) A reduction projection catadioptric optical system according to claim 98, wherein the image of the object off the optical axis is formed within an annular shape area.